

SYSTEMATIC POSITION OF THE GENUS
GLYPTOZARIA IREDALE
(PROSOBRANCHIA: GASTROPODA)

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Abstract.—The genus *Glyptozaria* comprises two living and one extinct species and is confined to deep-water environments in the western Pacific where it is best known from the Australian region. Anatomical, radular, opercular, and shell characters derived from the study of the type-species, *Glyptozaria opulenta* (Hedley), indicate its placement in the Cerithiidae rather than the Turritellidae, its previous familial assignment. An historical review of the literature, synonymy, and discussion of the systematics are presented.

Monographic studies of the family Cerithiidae Fleming have revealed a number of genera whose assignment to the family is uncertain. Many genera are poorly defined and based only on shell characters. As a result, some taxa are erroneously referred to the Cerithiidae and others, which belong there, are assigned to related families, such as the Turritellidae Woodward.

This study was prompted by examination of a large series of tiny, deep-water cerithiaceous snails dredged off the coast of Queensland, Australia by HMAS *Kimbla*. These specimens are in the genus *Glyptozaria* Iredale, 1924 and conspecific with *Glyptozaria opulenta* (Hedley, 1907). Several specimens preserved in alcohol allowed me to examine the operculum, radula, and gross anatomy. Although too poorly preserved for histological sections or accurate sex determination, the material provided the additional characters necessary for a proper diagnosis of the genus and definitive assignment to the family Cerithiidae.

The following account presents a brief nomenclatural history of the genus, a new description of the type-species and genus, a synonymy with commentary, and a discussion of the systematic position of *Glyptozaria* and some aspects of its distribution and biology.

Historical Review

The proper familial assignment of *Glyptozaria* has been uncertain. The type-species of the genus, *G. opulenta*, was originally described as a *Turritella* species by Hedley (1907:292) without knowledge of the operculum or radula. Iredale (1924:248) proposed the genus *Glyptozaria*, noting that all Australian turritellids had a sinus in the outer lip while *Turritella opulenta*

Hedley lacked this feature. He suggested that *Glyptozaria* resembled *Argyropeza* Melvill and Standen, 1901. Iredale (1925:267–268) later remarked that *Turritella opulenta* had been transferred to the genus *Mathilda* Semper, 1865, by Tate, but that this assignment was as unsatisfactory as *Turritella*. Both Thiele (1929:181) and Wenz (1939:653) placed the genus in the Turritellidae with a query. Thiele (1929:181) referred *G. opulenta* to the genus *Tachyrhynchus* Mörch, 1868. Cotton and Godfrey (1931:59) and Iredale and McMichael (1962:47) listed the genus under the Turritellidae without comment. Marwick (1957:164) also regarded *Glyptozaria* as a turritellid but assigned it to the subfamily Turritellopsinae Marwick along with the genera *Kimberia* Cotton and Woods, 1935 and *Turritellopsis* Sars, 1878. Garrard (1972:331–332) followed Marwick's (1957:164) arrangement but noted that the placement of *Glyptozaria* in the family Turritellidae was open to doubt. He believed that the genus was intermediate between the Turritellidae and Cerithiidae and suggested that discovery of other species in the future might warrant the establishment of a separate family to accommodate them.

Laseron (1951:332–333) believed that *Glyptozaria* was congeneric with a large snail described by Iredale (1929:186) as *Mathildona euglypta*. Iredale (1929) believed that *M. euglypta* was closely related to the genus *Mathilda* Semper but Laseron (1951) considered *Mathildona* to be a synonym of *Glyptozaria* and stated that he did not think the latter genus had any connection with the Turritellidae. Laseron (1951) referred *Glyptozaria* to the family Pyramidellidae Gray, perhaps the most unusual assignment given it by any author.

Materials and Methods

Numerous dry lots and a few specimens preserved in alcohol were examined with a Wild stereomicroscope and measurements of the shell and animal made with an ocular micrometer. Drawings of the animal were made using a camera lucida. Scanning electron micrographs of the shell and radula were taken with a Cambridge Mark II Stereoscan scanning electron microscope.

The following abbreviations appear in the text: AMS, Australian Museum, Sydney; ANSP, Academy of Natural Sciences of Philadelphia; HMAS, Her Majesty's Australian Ship.

Material Examined

JAPAN: ANSP 243278, Tosa.

QUEENSLAND, AUSTRALIA: AMS C117193, 24.5 mi E of Lady Musgrave Is, 339–348 m, HMAS *Kimbla*, Sta. 3; AMS C117192, 25 mi E of Lady Musgrave Is, 348–357 m, HMAS *Kimbla*, Sta. 2; AMS C117185, NE of Lady Musgrave Is, 365 m, HMAS *Kimbla*, Sta. 24; AMS C117183, E of

North West Is, 284 m, HMAS *Kimbla*, Sta. 22; AMS C117183, E of Lady Elliot Is, 476–531 m, HMAS *Kimbla*, Sta. 1.

Family Cerithiidae Fleming, 1828

Glyptozaria Iredale, 1924

Glyptozaria Iredale, 1924:248 (Type-species, by original designation, *Turritella opulenta* Hedley, 1907).—Thiele, 1929:181.—Cotton and Godfrey, 1931:59.—Cotton and Woods, 1935:382.—Wenz, 1939:653.—Laseron, 1951:332.—Marwick, 1957:164.—Iredale and McMichael, 1962:47.—Garrard, 1972:331–334.

Generic description.—Shell thin, slender, turreted, having angulate whorls and overall cancellate sculpture. Protoconch smooth, suture deep. Aperture ovate with slight anterior siphonal canal. Operculum ovate, corneous, moderately spiral with subcentral nucleus. Radula taenioglossate with long, curved, nearly smooth marginals. Animal with broad head and large eyes. Mantle edge bilobed and papillate. Stomach large, rectum wide. Osphradium vermiform; pallial gonoducts open.

Remarks.—This genus comprises two living species, *Glyptozaria opulenta* (Hedley, 1907) and *G. columnaria* Cotton and Woods, 1935, and a fossil species from the Middle Miocene of Victoria, *G. transenna* (Tenison-Woods, 1879) (Garrard, 1972:334). Although these tiny deep-water snails bear some resemblance to *Turritella* species, I believe they should be assigned to the Cerithiidae. Iredale (1924:248) also noted the cerithiid aspect of *Glyptozaria* when he compared it with *Argyropeza* Melvill and Standen, 1901. My recent review of this group (Houbrick, 1980) refers it to the Cerithiidae; however, I do not agree that *Glyptozaria* resembles *Argyropeza* species because the protoconchs of species in that genus are completely different from those of *Glyptozaria* species.

Many of the smaller turritellid genera are based on tiny deep water species for which only the shells are known. The assignment of *Glyptozaria* to the Turritellidae has been questioned by several authors (Thiele, 1929:181; Wenz 1939:653; Garrard, 1927:332). Marwick's (1957:164) referral of *Glyptozaria* to the subfamily Turritellopsinae is unsatisfactory because the radula of the type-species of *Turritellopsis* Sars, 1878, the type-genus, lacks marginal teeth. Other species, referred to *Turritellopsis*, have normal taenioglossate radulae; thus, the subfamily appears to be a somewhat artificial group.

Cerithiid characters in *Glyptozaria* are shells with a distinctly defined anterior siphonal canal, former varices on the body whorl, cancellate sculpture due to axial riblets and spiral cords, and an operculum with a subcentral nucleus and ovate shape. The gross anatomical features of the head-

foot and mantle edge are unlike those described for *Turritella* species. The radula is also not like those depicted for *Turritella* species. The marginal teeth resemble those of *Clavocerithium taeniatum* (Quoy and Gaimard) and *Rhinoclavis sordidula* (Gould), both cerithiids (see Houbbrick, 1978:71, 126), but do not taper as much at their distal ends. The marginal teeth of *Glyptozaria* also resemble those depicted by Troschel (1861:153, pl. 12, fig. 13) for *Turritella lactea* Möller, 1842, which is a *Mesalia* or *Tachyrhynchus* species. The genus *Mesalia* Gray is unknown anatomically and the features of its aperture, particularly the shallow anterior siphonal canal, render its assignment to the Turritellidae suspect. *Tachyrhynchus* Mörch, 1868 is similar to *Mesalia* and equally unknown, anatomically. As mentioned earlier, Thiele (1929:181) referred *Glyptozaria* to this group. I suggest that *Tachyrhynchus* is also inappropriately placed in the Turritellidae because both the aperture and anterior canal appear to be unlike those of *Turritella* species, but are more like those of *Glyptozaria*. I further suggest that *Glyptozaria*, *Tachyrhynchus* and *Mesalia* are more properly assigned to the Cerithiidae, perhaps as a subfamily. There is, however, not enough anatomical evidence to justify proposal of such a group at this time.

Some smaller, deep-water turritellid snails of the genus *Colospira* Donald, 1900, subgenus *Ctenocolpus* Iredale, 1925, may superficially resemble *Glyptozaria* species in sculpture but are easily distinguished from them by the lack of an anterior siphonal canal.

The assignment of *Glyptozaria* to the Pyramidellidae (Laserson, 1951:332) is not correct because *Glyptozaria* has a taenioglossate radula and lacks a heterostrophic protoconch. Laserson's (1951:333) referral of *Mathildonia euglypta* Iredale, 1929 to the genus *Glyptozaria* is also inappropriate because the former has a typical mathildid protoconch, tilted on its axis, not at all like that of *Glyptozaria* species.

Glyptozaria opulenta (Hedley, 1907)

Figs. 1–3

Turritella opulenta Hedley, 1907:292, pl. 54, fig. 9 (Holotype: AMS, c.16764;

Type-locality: 146 meters off Narrabeen, Tasman Sea).

Glyptozaria opulenta (Hedley).—Iredale, 1924:248; 1925:267–268; Cotton and Godfrey, 1931:59, pl. 2, fig. 5; Allan, 1950:92; Laserson, 1951: 333, fig. 91; Marwick, 1957:164, figs. 69–70; Garrard, 1972:332, pl. 29, fig. 15.

Shell description (Fig. 1; Table 1).—Shell small, ranging in length from 6–8.6 mm, elongate and having apical angle of 16 degrees. Teleconch comprising about 10 convex, angulate whorls with cancellate sculpture. Embryonic shell (protoconch I) inflated, smooth, one and a half whorls and with straight lip. First 7 whorls of teleoconch each with weak axial riblets and 2 strong spiral cords bearing pointed beads where they cross the axial rib-

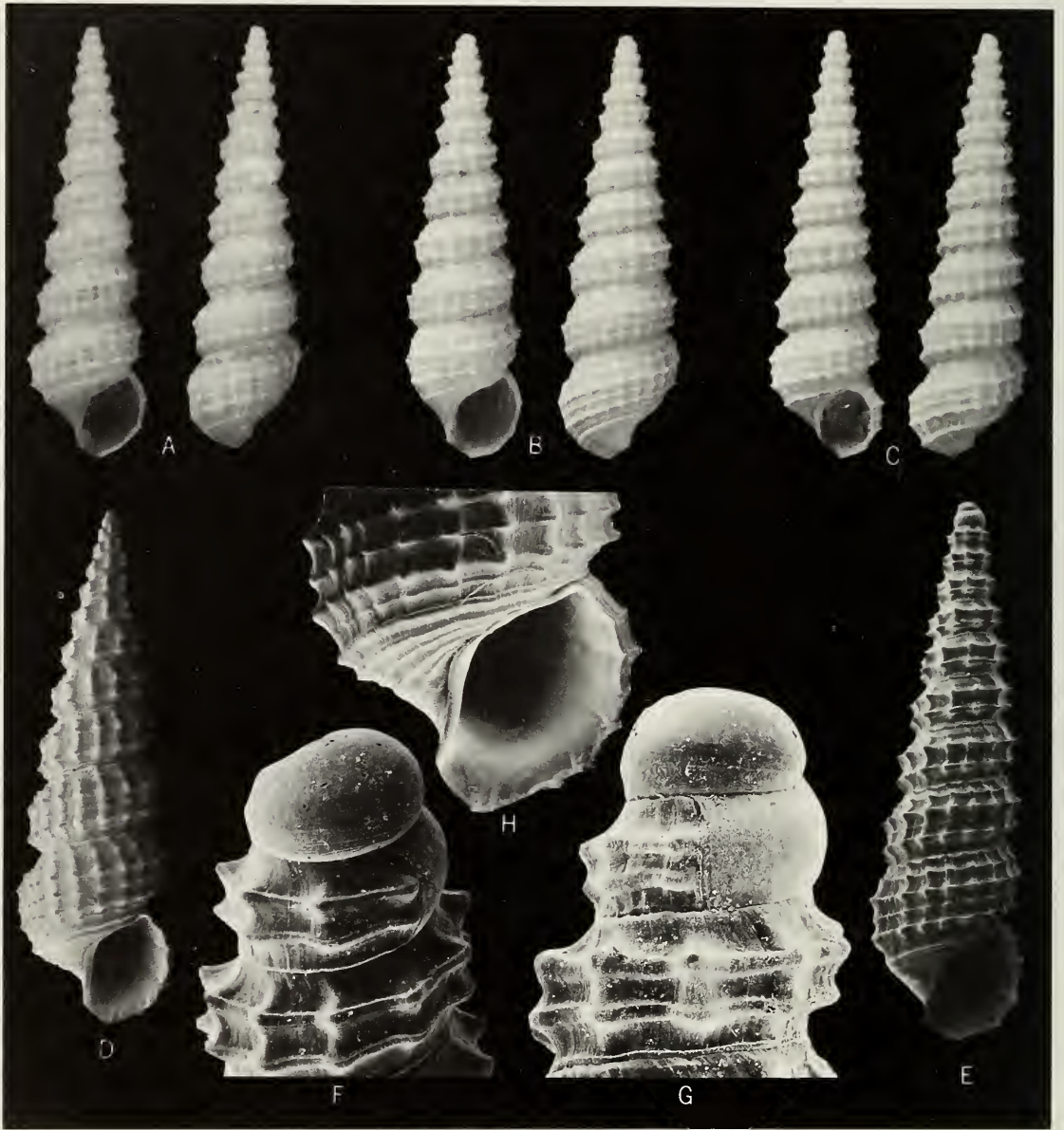


Fig. 1. *Glyptozaria opulenta* showing variations in shell sculpture and form. A–C, Shells from 339–348 meters depth, 23°33.7'S, 150°37'E, 24.5 mi E of Lady Musgrave Is, Queensland; AMS C117193. A, Live-collected specimen demonstrating shiny shell (7.5 mm long); B, Shell of dead specimen 8.1 mm long; C, Same as B, 8 mm long. D–H, SEM micrographs of shells from 342–357 meters depth, 23°44'S, 152°49'E, 0.25 mi E of Lady Musgrave Is, Queensland; AMS C117192. D, Specimen showing well-developed anterior siphonal canal and details of outer lip sculpture (9×); E, Details of shell sculpture and large body whorl varix opposite outer lip (17×); F, G, Protoconch showing smooth embryonic whorls, straight lip of embryonic shell and sharp transition between embryonic and juvenile sculpture (120× and 95×); H, Detail of aperture, anterior siphonal canal and sculpture of lower body whorl (35×).

lets. Eighth whorl with 3 spiral cords, the middle one being weakest. Penultimate and body whorls each with 4 spiral cords overlaying about 20 weak axial riblets. Upper cord weak, the next strong, the third weak, and the lower one strong. Upper portion of each whorl deeply impressed at suture

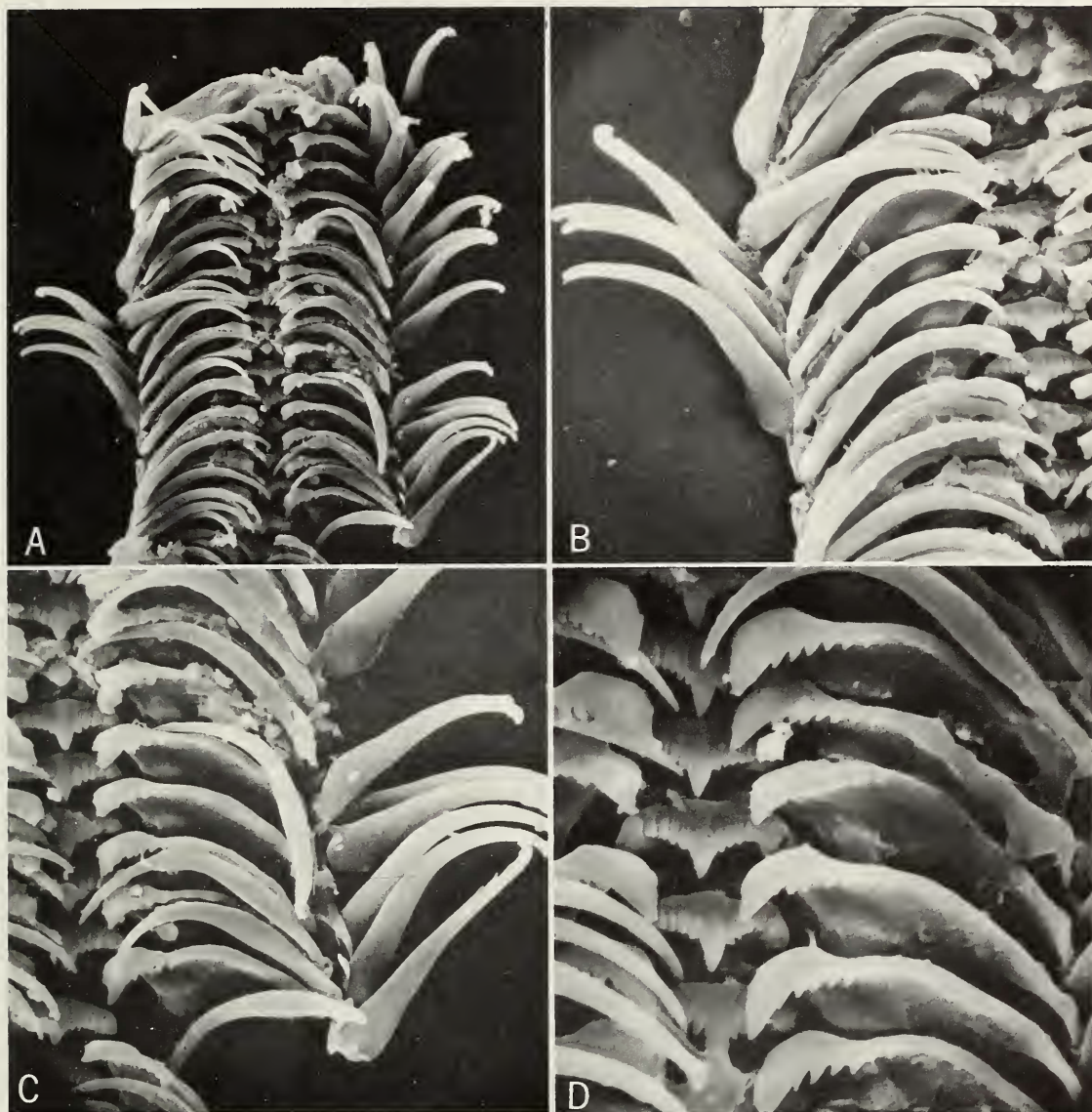


Fig. 2. Scanning electron micrographs of the radula of *Glyptozaria opulenta*: A, Portion of radular ribbon with some of the marginal teeth folded back (500 \times); B, Half row, showing smooth sickle-like marginal teeth and their relationship to lateral teeth when folded in normal position (1000 \times); C, Half row, showing lateral teeth (1000 \times); D, Detail of rachidian and lateral teeth showing basal plates and cusps (2000 \times).

Table 1.—Analysis of shell characters (measurements in mm).

Statistic	n = 15	\bar{x}	SD	Range
Shell length		6.85	0.69	5.9–8.6
Shell width		1.81	0.15	1.7–2.2
Aperture length		1.26	0.18	1.0–1.6
No. whorls		10	0.59	9–11
No. axial ribs		20	2.25	17–25

\bar{x} , mean.

SD, standard deviation.

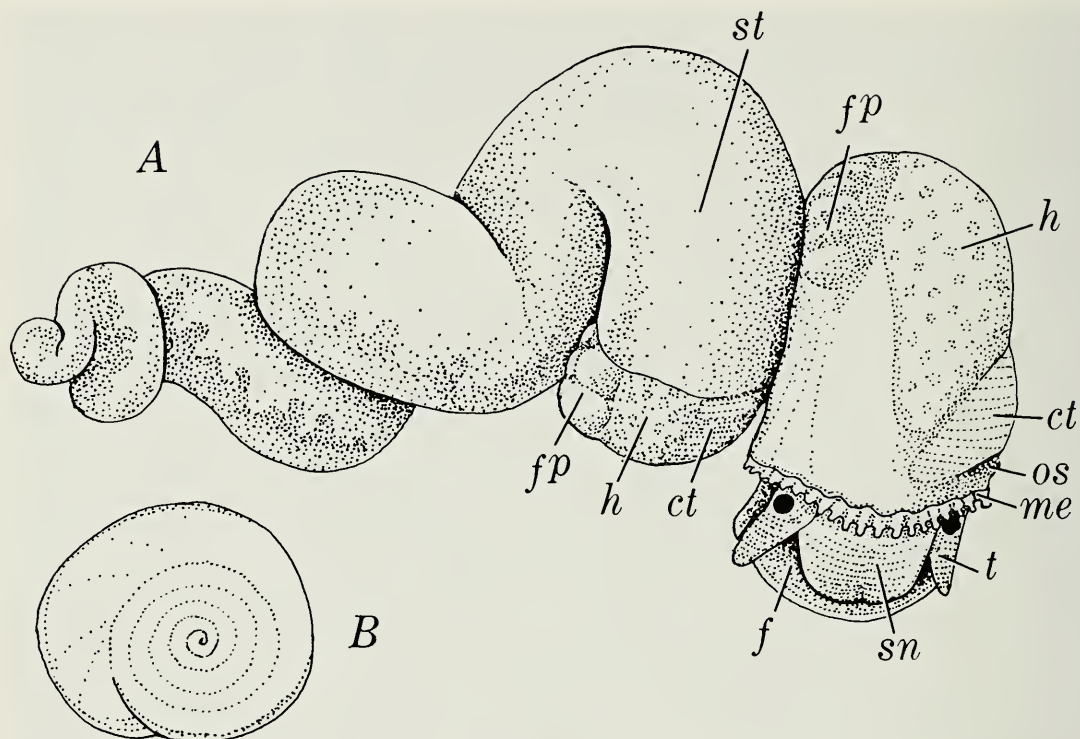


Fig. 3. A, Animal of *Glyptozaria opulenta* removed from shell (5 mm long); B, Operculum. Abbreviations: *ct*, ctenidium; *f*, foot; *fp*, fecal pellet; *h*, hypobranchial gland; *me*, mantle edge; *os*, osphradium; *sn*, snout; *st*, stomach; *t*, tentacle.

and framing sutural ramp. Strong varix on body whorl opposite outer lip. Suture straight, impressed. Base of body whorl moderately compressed and bearing 5 spiral cords. Aperture ovate, a little over one-fifth length of shell. Columella nearly straight, slightly concave. Anterior siphonal canal short, wide, and shallow. No anal canal. Outer lip convex, slightly crenulate at edge, with interior weakly incised spiral lines. Shell color white, translucent. Operculum (Fig. 3B) ovate, thin, corneous, outwardly concave and moderately spiral with sub-central nucleus.

Radula (Fig. 2).—Radula tiny, fragile, taenioglossate (2 + 1 + 1 + 1 + 2). Rachidian tooth 'T'-shaped, deeply impressed on sides of basal plate (Fig. 2D). Top of rachidian moderately convex and bearing large pointed central cusp flanked on each side with 4–5 tiny denticles that are nearly fused. Basal plate of rachidian with narrow neck and having wide, elongate baso-lateral projections. Lateral tooth (Fig. 2C, D) rhomboidal with outer elongate, lateral projection inserting onto radular basal membrane. Lateral serrated on inner top half with a tiny inner denticle, a large elongate cusp and 5–6 sharp denticles, respectively. Basal plate of lateral tooth slightly convex at bottom and bearing small, blunt, central peg. Marginal teeth (Fig. 2B, C) long, curving and spatulate at base where inserted on basal radular

membrane. Marginals tapering to blunt point at tips. Inner marginal tooth with 2 microscopic denticles on inner surface of tip. Outer marginal smooth.

Animal (Fig. 3).—Preserved animal comprising about 7 whorls, color nearly white, lightly pigmented with tan, on head-foot. Foot (Fig. 3, *f*) of moderate size, bearing propodial mucus gland. Head broad and short bearing wide, bilobed snout (Fig. 3, *sn*) and 2 thick cephalic tentacles (Fig. 3, *t*), each with a large black eye on the outer part of the tentacular, peduncular stalk. Mantle edge (Fig. 3, *me*) bilobed and with tiny short papillae. Stomach (Fig. 3, *st*) large, about 2 whorls long. Mantle cavity spacious, about one and a half whorls deep. Thin, vermiform osphradium (Fig. 3, *os*) adjacent to monopectinate ctenidium (Fig. 3, *ct*) that has thick filaments. Hypobranchial gland wide (Fig. 3, *h*), relatively thin, composed of tear-shaped ridges containing numerous fine spherules. Rectum large, filled with large, ovoid fecal pellets (Fig. 3, *fp*) comprised of fine detritus. Pallial gonoducts open, details unknown. Sexes probably separate. Spawn unknown, but direct development indicated by form of embryonic shell.

Remarks.—This species is the type-species of the genus. It is so distinctively sculptured that there is little chance it will be confused with its two other congeners. There is some variability in the axial and spiral sculpture. The anterior siphonal canal (Fig. 1H) is present in adults with fully developed outer lips but is usually lacking in immature or broken specimens. Live-collected shells have a translucent, glistening, white color (Fig. 1A) while shells of dead animals tend to be more chalky and opaque (Fig. 1B, C).

The four specimens I examined from Tosa, Japan (ANSP 243278) are larger than those from Australia and average about 11 mm in length. They also have shallower anterior siphonal canals and broader apertures. Although they may differ enough to constitute a separate species, I am reluctant to make a decision until more comparative material from Japan is available. Should they prove to be distinct, the geographic range of *Glyptozaria opulenta* would be considerably diminished. In this paper, I regard them to be conspecific.

Nomura and Niino (1940:68–69, pl. 1, fig. 3) described *Bittium urasimum*, a deep-water species dredged off the coast of Hukui Prefecture in the Japan Sea, which is similar to *Glyptozaria opulenta* but differs by lacking strong spiral sculpture and a cancellate appearance.

Glyptozaria opulenta somewhat resembles the turritellid species *Colospira curialis* (Hedley, 1907); however, the sculptural details of the latter are quite different and it lacks an anterior siphonal canal.

Biology and distribution.—This species lives in depths ranging from 72–531 meters. Garrard (1972:332) cited a depth range of 115–155 meters but the specimens examined from deep water off Queensland were all taken in deeper depths of 284–531 meters. The substrate was a fine gray mud. The

radula, large stomach, and fecal pellets point to detrital or deposit feeding. The small, bulbous, unsculptured protoconch or embryonic shell (Fig. 1F, G) with straight lip indicates a direct development (see Jablonski and Lutz, 1980:331). This species and its two congeners appear to be confined to the Indo-west-Pacific. *Glyptozaria* is recorded mostly from East Australia but also occurs as far south as Melbourne. I note only one record from Japan.

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